

APPLICATION
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TITLE: BROADCAST COMMUNICATION SYSTEM WITH
DYNAMIC CLIENT-GROUP MEMBERSHIPS

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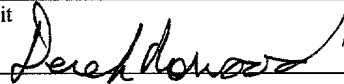
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BROADCAST COMMUNICATION SYSTEM WITH DYNAMIC CLIENT-GROUP MEMBERSHIPS

BACKGROUND

5 A broadcast communication system may include a host that transmits messages to a number of client devices. An example of a broadcast communication system is a digital cable system that transmits television signals over a cable line from a head end to set-top appliances connected to customers' televisions. The head end may transmit general system signals, such as basic cable channels, to all set-top appliances in the system. The head end may also send client-specific signals, including pay-per-view programs or
10 authorizations that are addressed to the set-top appliances of customers that ordered the pay-per-view programs.

At any given time there may be many messages being transmitted over the system, many of which may not be intended
15 for all of the client devices. At a certain traffic level and demand for particular messages, individually addressing client-specific messages may be cumbersome and time-consuming for the host processor and reduce the available bandwidth in the communication link. It may therefore be desirable to
20 assign clients to groups and address messages to the group rather than the individual clients, and to update the group

membership records at the head end and client devices as they are added, modified, or deleted from the system.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic diagram of a communication system capable of dynamically grouping client devices according to an embodiment.

Figure 2 is a schematic representation of a message format including group addressing according to an embodiment.

Figure 3 is a flowchart illustrating an operation for updating group memberships according to an embodiment.

Figure 4 is a flowchart illustrating an operation for receiving group directed messages according to an embodiment.

DETAILED DESCRIPTION

Figure 1 illustrates a communication system 100 according to an embodiment that may dynamically assign client devices to groups in the system. The system may include a host 102 that may broadcast messages to client devices 104, 105 in the system. The messages may be addressed as general call messages intended for all client devices in the system, client-specific messages intended for particular client devices, and/or group-specific messages intended for client devices belonging to particular groups in the system.

The host 102 may create, modify, and remove groups from the system. A group may include one or more member client devices, and a client device may be a member of none, one, or many groups. The groups may be dynamic, with group memberships changing over time.

The host 102 may transmit messages to client devices over a communication link 106. A system server 108 may format messages and transmit them from a transmitter 110. The system server 108 may format the messages into packets 200 that include a header portion 202 and a payload portion 204 as shown in Figure 2. The header portion 202 may include a client identifier for a client specific message, or a group identifier for a group-specific message. The payload portion 204 may include content such as audio and video signals for television programs and movies, data for electronic program guides and advertisements, software modules for video games, and system management messages. The system management messages may include, for example, authorization information, billing information, and diagnostic and maintenance software modules for servicing the client device 104, 105.

In an embodiment, the header portion 202 may include a number of fields. These fields may include, for example, a protocol version field 210, a target type field 212, a target

field 214, a message identifier field 216, a message type field 218, and a payload size field 220.

The value in the protocol version field 210 may identify the version of the protocol used to describe the message.

5 The value in the target type field 212 may be a Boolean flag which identifies the identifier in the target field as either a client identifier, e.g., value = 0, or a group identifier, e.g., value = 1. The value in the target field 214 identifies the intended target of the message, which may
10 be a particular client or a group of clients.

15 The host 102 may transmit messages multiple times, e.g., in a message carousel, to capture client devices that are off or otherwise unavailable at the time of the first transmission. The value in the message identifier field 216 may identify a message as a new message from the host 102, or a repeated message.

20 The value in the message type field 218 may indicate the type, or purpose, of the message. These types may include, for example, test messages, software download schedule information, and alert messages.

 The value in the payload size field 220 may indicate the number of bytes in the payload portion 204. The payload size value may be compared to an actual count of the bytes received in the payload as an error checking measure.

The host 102 may include a client profile database 112.
A client device may have an individual client identifier.
That client identifier may be associated with profile
information for that client device in the client profile
5 database 112. The profile information may include information
about a particular client device and customer. This
information may include, for example, services and/or products
the client device is authorized to receive, orders and
subscriptions placed by the customer, geographic and contact
10 information, and demographic information. The demographic
information may include, for example, the customer's household
income, number and age of children, interests, service and
program preferences, number and type of consumer appliances,
and historical information, such as payment records, and past
15 subscriptions and orders placed by the customer.

Figure 3 illustrates an operation 300 for updating
dynamic groups in the system according to an embodiment. The
flow of the operation 300 is exemplary, and blocks in the
flowchart may be skipped or performed in different order
20 according to alternate embodiments.

A group management server 120 may include hardware and
software for creating new groups and modifying existing groups
based on information in the client profile database 112. The
group management server 120 may create a new group from

information in the client profile database 112 in block 302.

The group may include member clients that share a common criterion. For example, a group may be created for the client devices of customers that have ordered a particular service, for example, a premium channel service in a digital cable system. Another group may be created for the client devices of customers that have ordered a particular product, for example, a video game software module. Another group may be created for customers that belong to certain demographic or geographic groups which may be targeted by certain advertisers. For example, households that report children between the ages of three and nine years may be included in a group that is targeted to receive an electronic catalog of age appropriate toys.

Each group may have a group identifier. The client identifiers of member clients in the group may be linked or otherwise associated with that group identifier in a client-group database 122. As shown in Table 1, a client device may belong to more than one group.

Client ID	Group ID
0x00000007	0x00001000
0x00000007	0x04000000
0x00000010	0x04000000

Table 1

The group management server 120 may compile a general membership file from the contents of the client-group database 122 in block 304 for transmission to the client devices 104, 105. The general membership file may be a data structure organized as, for example, a file, a database, or a table. The client identifiers of member clients may be mapped to the corresponding group identifier in the general membership file. The compiled general membership file may be transmitted to the client devices in block 306.

The general membership file may be relatively large, and the host may compress the general membership file prior to transmission to conserve the processing resources of the client devices. The general membership file may also be encoded with error checking data.

The client device 105 may include a receiver connected to the communication link 106 for receiving the general membership file and messages from the host 102, a receiver controller 132 to inspect transmissions from the host, and an identifier memory 134. The identifier memory 134 may include a client identifier file 136 to store the individual client identifier of the client device and an internal membership file 138 to store the group identifier(s) of the group(s) in which the client device 105 is currently a member.

Client devices in the system may receive the general membership file in block 308 and use it to update their internal membership files in block 310. When the client device 105 receives the general membership file, the receiver controller 132 may inspect the file for group identifiers the client identifier is associated with and compare those group identifiers to the group identifiers currently stored in the identifier memory 134. Based on this comparison, the receiver controller 132 may store new group identifiers that are associated with the client identifier in the identifier memory 134. The receiver controller may also delete group identifiers that are no longer associated with the client identifier from the identifier memory 134. Thus, the receiver controller 132 may update the internal membership file 134 to agree with the group-client associations contained in the last general membership file transmitted.

The host 102 may transmit the general membership file repeatedly to account for client devices that were not available for reception at the time the general membership file was first transmitted. Such unavailable client devices may include those that were off or out of reception range at the time of the first transmission. Unavailable client devices may also include devices that were busy handling operations having a higher priority than receiving and

handling the general membership file. For example, if a customer is using the client device 105, for example, to decode a video or voice signal, the client device 105 may ignore the general membership file and wait for the next
5 transmission.

To reduce the number of unavailable client devices, the host may transmit the general membership file at off-peak times, when many client devices may be idle and better able to utilize their processor resources to handle such system
10 functions. For example, in a digital cable system, the general membership file may be transmitted when most customers are not watching television, for example 3 a.m. In a wireless phone/PDA system, the general membership file may be transmitted every several hours in carousel fashion.

15 The group management server 120 may modify the groups in the client-group database 122 over time in block 314 in response to changed circumstances. For example, a new group may be generated for a new service provided by the host 102. An existing group may be deleted when a service campaign ends.
20 New members may be added to a group, for example, new subscribers to a service. Existing members may be removed from a group, for example, subscribers who cancel or are delinquent in payment.

When the group management server 120 modifies the groups in the client-group database 122, the operation 300 may return to block 304 and compile a new, updated general membership file. The updated general membership file may be transmitted
5 upon being compiled or at a next scheduled transmission time.

Figure 4 illustrates an operation 400 for updating dynamic groups in the system according to an embodiment. The flow of the operation 400 is exemplary, and blocks in the flowchart may be skipped or performed in different order
10 according to alternate embodiments.

When the client device 105 receives a message in block 402, the receiver controller 132 may inspect the target type field 212 and target field 214 of the message in block 404 and compare it to the client identifier or the group identifier(s)
15 in the identifier memory in block 406. If the identifier in the header portion does not match any identifier in the client device's identifier memory 134 in state 408, the message may be discarded in block 410. If the identifier in the header portion matches an identifier in the identifier memory 134,
20 the message may be passed on to a processor 140 in block 412.

The processor 140 may include a microprocessor for executing instructions stored in a memory 142 and processing data. The processor may include a signal processor, such as a digital signal processor (DSP) for processing compressed and

encoded digital signals, for example, digital video and audio signals. The processor 140 may extract the contents of the payload portion 204 in block 414 and store the payload in the memory 142 and/or prepare the payload for output to an output device 144. The output device 144 may include, for example, a television, a liquid crystal display (LCD) or cathode ray tube (CRT) display screen, and/or a speaker.

EXAMPLES:

In an embodiment, a digital cable system may include subscription-based groups. When a customer subscribes to a premium channel service, the group management server 120 at the host 102 may update the client-group database 122 to include the customer's client device identifier in the premium channel group. At the next broadcast of the general membership file to the client devices 104, 105 in the system, the customer's client device 105 may receive and inspect the general membership file for group identifiers associated with the client device's individual client identifier. Finding an association between the client identifier and the premium channel group identifier, the receiver controller 132 may update the identifier memory 134 to include the premium channel group identifier.

After the update, the receiver controller 132 of the client device 105 inspects the headers of messages transmitted

by the host 102, and passes messages that include premium channel group identifier in the header 202 to the processor 140. The processor 140 may extract the payload and output the digital video and audio signals of the premium channels to the customer's television 144.

The customer may cancel the subscription to the premium channel service. If so, the group management server 120 may remove the customer's client device identifier from the premium channel group in the client-group database 122. In the next general membership file transmission, the receiver controller 132 at the client device 105 may inspect the general membership file for an association between the premium channel group identifier in the internal membership file 138 and the client identifier in the client identifier file 136. Finding no association, the receiver controller 132 may update the internal membership file 138 by deleting the premium channel group identifier from the membership file 138.

In another embodiment, the digital cable system may include geographic-based groups. For example, a supermarket may request that the host transmit an electronic advertisement for a sale campaign to system customers in the vicinity of the supermarket. The group management server 120 may query the client profile database 112 for clients in a geographical area, defined, for example, by zip code(s). The group

management server may generate a sales campaign group identifier and link it to the client identifiers returned from the zip code query. An updated general membership file may be transmitted to the client devices in the next transmission cycle, and the member client devices updated to include the sales campaign group identifier in their identifier memories. The system server 108 may format the electronic advertisement into a message(s) with the sales campaign group identifier in the header 202. The message(s) may be transmitted and received by members of the group. The electronic advertisement may be displayed on the customer's television 144 automatically or when selected by the customer.

When the sale campaign ends, the group management server 120 may delete the group from the client-group database 122 and transmit an updated general membership file. Upon receiving the updated general membership file, the members of the sale campaign group may delete the sale campaign group identifier from their identifier memories.

In another embodiment, the system may be a wireless network and the client devices may be hand-held PDA units. The PDA units may include Global Positioning System (GPS) modules. The PDA may periodically transmit their current position to the system host. The system host 102 may update the client profile database 112 with this geographic

information. An advertiser, for example a department store having a weekend sale, may use this geographic information to target customers in the vicinity of the department store. A group may be created and the general membership file
5 transmitted periodically over the sale weekend to capture customers traveling in the vicinity of the department store. The group may then be deleted at the end of the sale weekend.

In an embodiment, the communication system 100 with dynamic client grouping may have a head end-to-set-top
10 appliance organization as in many cable, digital cable, and television satellite dish systems. In an alternative embodiment, the communication system 100 may have a central station-to-client organization as in many wireless telephone, wireless internet, wireless personal digital assistant (PDA)
15 systems.

The communication link 106 may be a transmission line such as co-axial cable, fiber optic, plain old telephone system (POTS), or digital subscriber line, or it may be a wireless RF signal transmitted via satellite or base stations
20 to a receiver, such as a dish, or a transceiver, such as those used in wireless hand-held devices. The communication link 106 may include a combination of such communication media.

A number of embodiments have been described. Nevertheless, it will be understood that various modifications

may be made without departing from the spirit and scope of the invention. Accordingly, other embodiments are within the scope of the following claims.

Parameter	Unit	Value
Mean	mm	1.2
Standard deviation	mm	0.2
Minimum	mm	0.8
Maximum	mm	1.6
Range	mm	0.8
Median	mm	1.1
Mode	mm	1.0
Skewness		0.5
Kurtosis		0.2
Mean	mm	1.3
Standard deviation	mm	0.3
Minimum	mm	0.9
Maximum	mm	1.7
Range	mm	0.8
Median	mm	1.2
Mode	mm	1.1
Skewness		0.4
Kurtosis		0.1
Mean	mm	1.4
Standard deviation	mm	0.4
Minimum	mm	1.0
Maximum	mm	1.8
Range	mm	0.8
Median	mm	1.3
Mode	mm	1.2
Skewness		0.3
Kurtosis		0.0
Mean	mm	1.5
Standard deviation	mm	0.5
Minimum	mm	1.1
Maximum	mm	1.9
Range	mm	0.8
Median	mm	1.4
Mode	mm	1.3
Skewness		0.2
Kurtosis		-0.1
Mean	mm	1.6
Standard deviation	mm	0.6
Minimum	mm	1.2
Maximum	mm	2.0
Range	mm	0.8
Median	mm	1.5
Mode	mm	1.4
Skewness		0.1
Kurtosis		-0.2
Mean	mm	1.7
Standard deviation	mm	0.7
Minimum	mm	1.3
Maximum	mm	2.1
Range	mm	0.8
Median	mm	1.6
Mode	mm	1.5
Skewness		0.0
Kurtosis		-0.3
Mean	mm	1.8
Standard deviation	mm	0.8
Minimum	mm	1.4
Maximum	mm	2.2
Range	mm	0.8
Median	mm	1.7
Mode	mm	1.6
Skewness		-0.1
Kurtosis		-0.4
Mean	mm	1.9
Standard deviation	mm	0.9
Minimum	mm	1.5
Maximum	mm	2.3
Range	mm	0.8
Median	mm	1.8
Mode	mm	1.7
Skewness		-0.2
Kurtosis		-0.5
Mean	mm	2.0
Standard deviation	mm	1.0
Minimum	mm	1.6
Maximum	mm	2.4
Range	mm	0.8
Median	mm	1.9
Mode	mm	1.8
Skewness		-0.3
Kurtosis		-0.6
Mean	mm	2.1
Standard deviation	mm	1.1
Minimum	mm	1.7
Maximum	mm	2.5
Range	mm	0.8
Median	mm	2.0
Mode	mm	1.9
Skewness		-0.4
Kurtosis		-0.7
Mean	mm	2.2
Standard deviation	mm	1.2
Minimum	mm	1.8
Maximum	mm	2.6
Range	mm	0.8
Median	mm	2.1
Mode	mm	2.0
Skewness		-0.5
Kurtosis		-0.8
Mean	mm	2.3
Standard deviation	mm	1.3
Minimum	mm	1.9
Maximum	mm	2.7
Range	mm	0.8
Median	mm	2.2
Mode	mm	2.1
Skewness		-0.6
Kurtosis		-0.9
Mean	mm	2.4
Standard deviation	mm	1.4
Minimum	mm	2.0
Maximum	mm	2.8
Range	mm	0.8
Median	mm	2.3
Mode	mm	2.2
Skewness		-0.7
Kurtosis		-1.0
Mean	mm	2.5
Standard deviation	mm	1.5
Minimum	mm	2.1
Maximum	mm	2.9
Range	mm	0.8
Median	mm	2.4
Mode	mm	2.3
Skewness		-0.8
Kurtosis		-1.1
Mean	mm	2.6
Standard deviation	mm	1.6
Minimum	mm	2.2
Maximum	mm	3.0
Range	mm	0.8
Median	mm	2.5
Mode	mm	2.4
Skewness		-0.9
Kurtosis		-1.2